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T/VI/R-1
28 September 1965

U N I T E D S T A T E S I N T E L L I G E N C E B O A R D

COMMITTEE ON DOCUMENTATION

TASK TEAM VI - INTELLIGENCE DATA HANDLING

RESEARCH AND DEVELOPMENT

MEMORANDUM FOR: Chairman, Committee on Documentation

SUBJECT: Transmittal of Task Team VI Report

1. The Task Team VI report is transmitted via this memorandum. You will note that recommendations for action are contained in each of Sections II, III, IV, V and VI. Those considered as requiring immediate action are summarized in Section VII.

2. I should like to commend the members of the Task Team for the work they have done and also to express individual thanks to the CODIB Support Staff member of the team.

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Chairman, CODIB Task Team VI

Attachment:
Task Team VI Report

GROUP 1
Excluded from automatic
downgrading and
declassification.

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U N I T E D   S T A T E S   I N T E L L I G E N C E   B O A R D

COMMITTEE ON DOCUMENTATION

TASK TEAM VI - RESEARCH AND DEVELOPMENT

REPORT ON INTELLIGENCE DATA HANDLING RESEARCH AND DEVELOPMENT

28 September 1965

S-E-C-R-E-T

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UNITED STATES INTELLIGENCE BOARD

COMMITTEE ON DOCUMENTATION

TASK TEAM VI - RESEARCH AND DEVELOPMENT

Report on Intelligence Data Handling Research and Development

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I. Introduction

"Intelligence Data Handling" has been adopted by Task Team VI as a title which characterizes to an extent a specific area of research and development. In particular, the phrase has been defined by the Team and approved by CODIB in the Terms of Reference of Task Team VI as follows:

> "intelligence data handling' is interpreted to include the processing of intelligence data among and between humans and machines. It includes the functions of receipt from collection sources, transformation, coding, storage, search, retrieval, manipulation, presentation and delivery and it involves usage procedures. It is concerned with existing and potential techniques, both manual and automated which offer promise of improving intelligence data handling techniques."

This definition of intelligence data handling readily identifies the work of the Task Team as being within the allowable province in CODIB. This is especially true in view of the definition of "documentation" adopted by CODIB and contained in DCID 1/4 of 23 April 1965:

> "Documentation is defined as the group of techniques necessary for the orderly presentation, organization and communication of recorded specialized knowledge, in order to give maximum accessibility and utility to the information contained."

Even with the clarity of definition attempted above, it is evident that a reasonably comprehensive consideration of all the aspects of data handling within the USIB community would be so all-encompassing as to be meaningless and to be lacking in utility. On the other hand, an exhaustive technical treatment of a few areas to the exclusion of the majority considered of import in the definition would present a distorted picture and would tend to hide, through omission, gross problem areas deserving of attention by the USIB community.

In what appears to be an effective compromise, the Team has prepared a report which attempts to provide the data necessary for answering pressing questions such as:

1. What policy mechanisms should exist for establishing a USIB community program in intelligence data handling research and development?

2. Are the existing and planned programs adequate in size, balanced in content, technically sound and adequately organized, managed and funded to attain the desired objectives?

3. In what ways can the scientific and technical leadership in intelligence data handling R&D be improved?

4. What are the outstanding opportunities in research and development and in practical applications which represent the difference between existing and planned programs and reasonable objectives?

5. What is the primary mechanism by which shortcomings in existing operational procedures, practices, techniques or equipment are translated into research and development requirements and communicated to the technical leadership of the USIB R&D community? How can this mechanism be improved?

6. Are there criteria for determining in which areas of intelligence data handling research and development the USIB community must be self-sufficient, need not be self-sufficient or should not be self-sufficient?

7. To what degree are the intelligence data handling research and development programs of the several USIB members mutually supportive?

In addition to providing the basic data and statistics in the Appendices, the report suggests an interpretation of the data in the light of the paramount questions isolated above. Further, experience of team members and resources available to them were utilized to provide possible and feasible answers to the questions. Because of the nature of the questions, the recognized diversity of interest of members

of the USIB community, the limitations imposed by security and the magnitude of the subject area, much of the supporting data is illustrative or inductive in nature, rather than exhaustive or deductive. The Team admits the danger of this type of evidence and recognizes the criticism which can be levied upon this approach; however, it pleads the impracticality of any other method and believes itself capable of defending in some detail the recommendations and conclusions contained in the report.

Although apparent from the questions posed, it is worth emphasizing that the Team considered conceptual and managerial aspects of R&D and R&D program establishment and organization to be more crucial and more in need of immediate attention than purely technical aspects. Accordingly, one will not find recommendations in the report concerning what technical approaches should be adopted, what type of equipment is best suited to a particular application, and the like. These aspects are considered secondary to the primary problem of establishing and attaining an adequate, effective research and development program for intelligence data handling within the USIB community. Futhermore, such specific listings of technical projects will be a natural fall-out of any successful R&D program.

The layout of the report represents the above-stated views of the Task Team. Section II deals with conceptual and managerial considerations and Section III with technical aspects of intelligence data handling research and development. These are followed by a section devoted to the allocation of resources for intelligence data handling research and development which represents the major portion of the data collection effort undertaken by the Task Team. Sections V and VI touch on isolated but important facets of intelligence data handling R&D; namely, the self-sufficiency of the USIB community in this R&D area and the primary processes involved in intelligence data handling. Finally, Section VII lists that subset of recommendations which the Task Team believes to be of immediate urgency. It should be noted that for each of the actions believed to be of immediate urgency there are estimates of the impact of such action on the resources of the USIB community. That is, funding and personnel requirements are stated to the best of the Team's ability to estimate. The impact on USIB community resources of the other recommendations found in the report has not been calculated. Such data can be provided upon request if deemed useful.

It is important to take into account the membership of Task Team VI in reviewing the recommendations and conclusions. Contributing members were drawn from CIA, OSD, DIA, Army, Navy, Air Force and NSA. (A complete membership list of individual name is contained in Appendix 3.) It is worthy of note also, since ramifications will be felt in several of the conclusions and recommendations, that 1) the FBI had no member because prior to FY66 it had no funded R&D in intelligence data handling, 2) the AEC volunteered no member although it sponsors R&D efforts considered within the Task Team's purview, and 3) the State Department supplied an observer[1] even though it had no funded R&D efforts in intelligence data handling. The National Science Foundation supplied consultants to the Task Team and the CODIB Support Staff provided a professional to serve as executive secretary.

The SCIPS report served as a valuable background for Team members and provided more pertinent data as basis for Team findings than any other single collection of material.

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[1] An observer rather than a member since the State Department felt it had no one who could actively participate in the work of the Task Team.

II. Conceptual and Managerial Considerations Concerning Intelligence Data Handling Research and Development

The Task Team attempted to find a framework of R&D goals within the USIB community upon which to attach specific managerial and technical tasks and within which to isolate gaps, deficiencies, achievements and highlights pertinent to intelligence data handling research and development. In its investigations, the Task Team discovered instead that the Intelligence Community as governed by USIB under the documented series of NSCIDs and DCIDs (National Security Council Intelligence Directives and Director, Central Intelligence Directives) has neither an organized set of R&D objectives, a policy for establishing R&D objectives nor a mechanism for accomplishing either[1]. This lack of objectives and policy is not surprising insofar as it appears to be analogous to that in the Federal Government as a whole; i.e., there are no explicitly stated federal or national R&D goals. However, there is a formal mechanism within the executive branch of the government for advising the President on R&D matters, for coordinating federal agency R&D programs and for isolating specific areas for concentrated study, improvement or change. This mechanism, of course, is comprised of the Scientific Advisor to the President, his staff in the Office of Science and Technology, and the Panels and Committees over which he presides. The USIB community, as part of the federal structure, is represented within this mechanism only insofar as its member agencies are individually represented. In addition, the USIB community in many ways and for many reasons functions as a self-contained entity isolated from the rest of the federal structure by organizational, managerial and security barriers. This isolation causes little or no confusion in operational matters.

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[1] Two exceptions were noted; namely, 1) NSCID 6 dated 18 Jan 61 which stated that NSA was assigned the responsibility for "conducting research and development to meet the needs of NSA and departments and agencies which are engaged in COMINT or ELINT activities; and coordinating the related research and development conducted by such departments and agencies", and 2) NSCID 8 dated 18 Jan 61, which stated that "The NPIC shall engage in or sponsor, as appropriate, the development of specialized equipment for the intelligence exploitation of photography and shall provide information about such specialized equipment to interested elements of the intelligence community for their own possible use or further adoption."

Such is not the case with respect to scientific and technical responsibilities of the USIB community. Here the community is not self-sufficient. These activities-managerial, research, development, test, engineering, evaluation and implementation responsibilities-are delegated or assigned in part or sometimes wholly to groups outside the community. With respect to intelligence data handling R&D, the Task Team believes such delegation to be useful and many times to be essential. This viewpoint is justified on the basis of one or more of the following reasons:

1. The greater part of the technical competence in general information handling (or information sciences technology) lies outside the Intelligence Community. This is not the case for certain specific areas as will be discussed later. (See Sections II and V)

2. Many aspects of intelligence data handling are identical to those of general information handling. (See Section V) As a result, R&D costs for effecting improvement could be so parcelled out within the federal agency structure that no agency or group, e.g., USIB, needs to bear a disproportionate share of the cost.

3. Sharing the R&D costs for common needs with other agencies will permit the Intelligence Community to concentrate its limited resources on those intelligence data handling efforts which are of unique or primary concern to it.

It should be emphasized at this point that, the concentration of technical competence in intelligence data handling outside the intelligence community may be viewed without alarm. However, lack of competence within the Intelligence Community in the applications of intelligence data handling techniques to intelligence problems or systems is unjustified. The Task Team believes that at present such inherent competence is marginal at best. This belief is borne out by documentable evidence concerning large, unsuccessful system projects within the Community, frequent use of contractors for system design and development, the current mediocrity of intelligence data handling techniques and systems, and the lack of evidence of concrete planning for application of more sophisticated technology as manifest in existing budgetary plans. The task of

documenting what is now just anecdotal experiences in support of the above indictments would be justified only if one could attest to learning by experience. The Task Team cannot so attest. As a result, supporting documentation does not form a part of this report.

It is frequently asserted that lack of federal or national objectives can be compensated for by the existence of well-structured and documented individual agency objectives. The implication of this premise to the USIB Community would be that well-founded member agency objectives in intelligence data handling research and development would form a suitable substitute for the lack of corresponding community goals. The Task Team attempted, then, to isolate individual agency objectives in order to assess their suitability. The factual results of this effort are contained in Appendix 1. It was determined that DIA, the military departments of DoD and NSA had documented objectives. The State Department had none. The existence of CIA objectives was not determined and the NSA objectives were not released to the Task Team. It was obvious, however, that the objectives isolated were not uniform in structure, were neither comprehensive nor cohesive, were grossly incomplete with respect to managerial considerations and were not intended as guidelines for R&D efforts. The Task Team was forced to conclude that the accumulation of individual agency objectives could not be used as a substitute for USIB objectives and that the individual objectives themselves were of little use in judging or relating R&D efforts planned or underway.

As a result of the rightful importance of intelligence data handling research and development, the need for sharing responsibility for it with groups outside the USIB Community, the lack of any existing USIB goals, policies or supporting mechanism to further necessary R&D and the lack of coordination among existing or planned R&D efforts, the Task Team recommends that a set of actions be taken. These actions are aimed at improving the managerial position of the USIB Community in its interface with other federal agencies or offices, in its interface with the non-governmental community and in its handling of intra- and internal-USIB Community operational requirements. It appears axiomatic that both the USIB community and its member agencies will benefit in their individual and mutual contacts with outside groups if they can operate with a uniform and professional negotiating posture. The actions recommended are discussed below.

1. A mechanism for establishing intelligence data handling R&D objectives and policies for the Intelligence Community should be established by USIB and formalized by documentation within the appropriate NSCID/DCID Series. The mechanism so established should be permanent in nature with a full-time executive secretary. It would differ from USIB Committees (such as CODIB) in that it would attempt coordination of USIB objectives, plans, policies, review and evaluations, would be the principal advisor to Chairman, USIB, and sould, if deemed advisable for critical areas, develop policies, plans, procedures with subsequent recommendation for delegation of R&D responsibility within USIB. It should be able to initiate requests for R&D planning and budgetary submissions for information and coordination functions but with no approval authority resident in its policy mechanism. The membership of the suggested group cannot contain, within itself, all the technical competence necessary to cover the field of intelligence data handling. It must be provided the means to utilize, on a continuing basis, consultants both from within and outside the Intelligence Community. Each USIB agency should have a member with alternate and meetings should be held at least monthly. Members should either have R&D authority, competence or both.

2. A formalized reporting mechanism should be established under USIB sponsorship to disseminate technical and planning information concerning intelligence data handling research and development with the USIB Community. Only dissemination of classified information would be involved, and channels affording needed security would be utilized. The reporting system would have the collateral function of acquisition of pertinent documentation, selection of relevent R&D material with subsequent maximum sanitization prior to dissemination. The Task Team has found that linking technology to the sponsoring organization or to the operational use for which it is intended all in the same document normally increases the security classification and, consequently, the inaccessibility of the technical data. For open source documents, existing information services

appear to be adequate. If it is found that they are not, additional requirements can be levied to preclude the USIB reporting system from having to handle such easily accessible information. The notion of a Central Register service for R&D technical and planning data should be considered seriously. The Task Team believes existing reporting mechanisms within individual USIB agencies can be used with little change. Initially, "bleed-off" of information from these established systems should suffice and should serve, in addition, to point up new requirements, if any, which must be imposed on USIB agencies to satisfy USIB intelligence data handling R&D needs. No requirements should be imposed prior to a serious initial attempt to use existing reporting systems. Judicious use of USIB agency personnel by the recommended policy mechanism should preclude need for funding for this function other than supporting administrative services (clerical, mail and the like).

3. Those responsible for intelligence data handling research and development must be made more aware of the importance of remaining cognizant of current and pertinent research and development. They must be vigorously encouraged if not gently coerced into making use of the information services available to them as government employees. It is recommended that this group--which will be termed the IDH-R&D community--be subjected to an established and scheduled evaluation to measure their effectiveness, competence and awareness of the current R&D underway. The importance of their functions in terms of the responsiveness of the intelligence community to any situation--crisis or normal--cannot be overestimated; and yet they exist as an unstructured, unrecognized and uncoordinated group with no required group allegiances and no "reward-punishment" mechanism. The Task Team had extreme difficulty in even isolating those responsible for intelligence data handling research and development (See Section IV B) and certainly found no IDH-R&D community. Many individuals who had responsibility for IDH projects were not even aware of anyone else having similar responsibilities. The policy mechanism recommended in an earlier paragraph should (a) establish an

agreed-upon organizational listing of the IDH-R&D community, (b) establish a "phone directory" of IDH-R&D community members with their recognized specialties and (c) provide to the IDH-R&D community a listing of information services available to them and of which they should avail themselves. In this latter regard there appears to be no evidence that the technical personnel concerned with intelligence data handling R&D differ from other government technical personnel. Accordingly, the DoD Study of the information usage habits of government scientists and engineers[1] should be applicable to them, and the Task Team feels no separate survey of the USIB community is needed. Most evidence, including that compiled by this last-mentioned study, points to either misuse or inadequate use of information services by technical personnel which is attributed primarily to lack of training in their usage. It is recommended, therefore, that USIB (CODIB) fund the compilation of a report listing available information services (some 400-500) and detailing their accessibility as well as procedures for their use. Concurrent with report preparation and distribution, an R&D effort should be undertaken to follow-up the distribution of the report within twelve months, by a study and evaluation of changes in information usage patterns of IDH-R&D personnel due to dissemination of the report. At that time, recommendations for improvements in information usage patterns should be useful since they can be based upon a common background of knowledge available to the IDH-R&D community. The last three specific recommendations, namely, an organizational listing and a phone directory of IDH-R&D personnel, a report listing the available information services and the follow-up study of usage patterns should probably be accomplished primarily by contract with the full time managerial services of two USIB personnel. Contractual effort is estimated to be approximately $150,000 and the time duration of the effort to be about nine months.

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[1] DoD User Needs Study, Phase I, Volumes I & II, May 14, 1965, Auerbach Corp.

4. An analysis must be made of the possible means of establishing a feed-back mechanism between the users of intelligence estimates and of finished intelligence and the IDH-R&D community. The analysis must result in the recommendation of a feasible feed-back mechanism to be introduced promptly. This is admittedly an elusive task. It must be recognized that it will require the tacit approval of USIB members and NSC members, among others. At the same time it will probably have to be done without user cooperation and without user understanding, and it will surely have to be done without interference with normal user activities. As a result, the accomplishment of such an analysis demands individuals of rather unique and phenomenal talents. They must be from within the USIB community with the addition of one or two outside experts in communications research and/or management. Presently, there is evidence that intelligence estimates or final products of all types are oftentimes lacking in completeness, in objectivity and in accuracy. The final users have no really effective manner to challenge such estimates nor any criteria of judging when they should be challenged. The errors in intelligence products are normally due to archaic or at least inadequate information analysis techniques, to a desire to prove a self-fulfilling prophecy, to incomplete use of existing raw intelligence, to lack of evaluation of results by objective experts, to the refusal to admit to usage of unreliable information, and the like. One often finds intelligence estimates going out of the community prefixed with minority opinions or containing statements such as "incomplete evidence nevertheless leads us to predict that...", "no new information was available on... and so previous estimates are still valid...", and so forth. It is essential that estimates containing these type statements be fed back into the IDH-R&D community for evaluation and correction of gaps indicated, for substitution of inferences more directly following upon given premises and, primarily, for introduction of better data handling techniques to intelligence analysts. There exists no such feed-back mechanism now. The desire for improvement of intelligence data handling techniques is, therefore, only a desire for

self-improvement on the part of researchers and analysts. The essential catalysts of user dissatisfaction and user pressure are lacking. There are no satisfactory substitutes for them and the recommendation of the Task Team is for immediate action to bring them to bear. The recommended analysis will require the part-time services of three-to-five experts from the USIB IDH Community for a period of about one year as well as the full-time assistance of two outside experts at a cost of approximately $75,000.

One should rightfully ask, after a review of the recommendations, what the harmful implications would be if they are not accepted. First of all, the Intelligence Community would continue to be vulnerable to external investigative and evaluative groups without having any recognized negotiating position from which to staff questions concerning intelligence data handling. The product of the intelligence community is information. The field of information sciences and services is a highly populated one in the scientific community. Intelligence data handling (R&D) is analogous to information sciences technology, and so one can expect a high interest in the intelligence data handling R&D activities of the intelligence community. Such interest is good and should be maintained; and investigations can be extremely productive provided that a true picture of IDH-R&D is presented to investigators and evaluators. This has not been the case in the past. Probes could be aimed anywhere with equanimity by external groups since there was no policy mechanism having information, data and coordinating responsibilities concerning intelligence data handling R&D. It is implicit in management doctrine that deficiencies are less when there is a responsible coordinating mechanism and that those deficiencies which do exist are both easier to find and to correct. It would, therefore, be of help to both external investigative groups and to USIB to have such a coordinating mechanism. Regardless of how well-intentioned the external group may be, when the data it is presented are fragmentary and not inter-related, its recommendations are of necessity even more fragmentary and less related to the real problems. They will "remove a thorn and by so doing implant a tumor." The Task Team believes the intelligence community can ill-afford any more such investigations and believes its recommended policy and reporting mechanisms to be essential as a remedy.

Secondly, the deleterious effect of having no over-all interagency or USIB objectives or policy in IDH-R&D can be seen if not heard at every

level of the R&D hierarchy. There is no real structure on which to "hang" R&D efforts other than the ephemeral structure of satisfying users' "requirements." Delegating responsibility for urgent projects is difficult and must be accomplished outside of normal community channels if it is done at all. Inability to delegate responsibility results inevitably in duplicative efforts on the part of every agency having some interest in the project. Examples can be cited and documented. A rather lamentable and frequent occurrence is the lack of any criteria against which to judge when a particular R&D effort has been pursued far enough and should either be abandoned or declared satisfactory. Security barriers are used quite effectively to barricade against attempts by other agency personnel to acquaint themselves with on-going R&D efforts. In the establishment of objectives and policies, the IDH-R&D mechanism must avoid empty statements. Objectives may be so broad as to be meaningless as for instance, "the improvement of intelligence data handling capabilities within the Intelligence Community." They may be so narrow as to preclude adequate coverage of all of IDH even by the use of a number of statements of objectives. To be useful, they must provide means of ensuring best possible uses of USIB community R&D laboratories, facilities, funding and manpower; they must encourage and authorize interagency communication and coordination; they must emphasize maximum use of resources and results found external to the Community; they must require interchange between the community and other governmental agencies and between the intelligence community and the scientific community; they must support federal objectives; and they must permit measurement of the impact of their pursuit on agency resources and on USIB community requirements. Without such policy and objectives, IDH-R&D will founder as more expensive equipment development and more complex and intellectually demanding technology sucks up more of the available community resources even without duplicative and unjustified efforts by individual uncoordinated agencies.

Thirdly, as mentioned above, technology and R&D are becoming more expensive both in talent and funding. The last ounce of usefulness must be realized from every project. The IDH-R&D community has to become better informed of completed and on-going R&D efforts everywhere. As a rough estimate, one tenth of one percent of the funding isolated for IDH-R&D in FY66, if spent on improvement of information usage patterns by IDH-R&D personnel, would permit each member of the IDH-R&D community the equivalent of a full semester's worth of college-level education each year. The improvement in the resultant R&D effort would conservatively

be 100 to 1000 times that expenditure. The distribution of a listing of information services available and the encouragement of their use seems a trivial but necessary first step in community self-improvement.

Finally, it would be presumptious to attempt to clarify a need that is as widely evident as that of a workable feed-back mechanism between users of finished intelligence and the personnel responsible for improving the use of intelligence collected.

The Task Team believes that the conceptual and managerial considerations discussed in this Section are vital to a healthy and constructive intelligence data handling research and development program aimed both at USIB community and at member agency needs.

III. Technical Considerations

A. Classification and Definition Schemes and Resulting Implications.

One would anticipate that technical aspects of intelligence data handling R&D should include a classification of the subject area, an identification of importance of the R&D areas involved, an isolation of gaps and deficiencies in R&D, a state-of-the-art survey and recommendations concerning needed efforts or skills. The Task Team had somewhat spotty success in its consideration of such technical aspects.

Members of the Task Team were aware of several attempts underway to develop classification schemes for informational sciences and believed that the Intelligence Community should encourage this activity and rely on the results rather than to produce separately a taxonomy or classification for intelligence data handling. It was felt that "intelligence data handling" overlapped in content many of the areas characterized by more widely used phrases such as "intelligence processing", "information sciences technology", "information systems", "non-numerical processing" and the like. Several classification schemes already developed or utilized were collected and were used by Team members in helping to resolve jurisdictional questions concerning the scope of intelligence data handling. Nine of these are attached as Appendix 4 but none are believed to be entirely satisfactory for classifying intelligence data handling for the purpose of this report.

To provide assistance in assessing the findings of the Task Team, certain exemplary areas have been singled out which are deemed of primary intelligence interest in order to illustrate what was considered within the scope of intelligence data handling and, more particularly, what was considered outside the scope. Examples of equipment or processes considered <u>outside</u> the purview of the Team include:

1. Data handling equipment whose sole purpose is that of guidance and sensor control or reconnaissance platforms

2. Communications-oriented EDP equipment such as switching computers and store-and-forward message devices

3. Physical security devices or techniques, e.g., COMSEC

4. Optical devices such as cameras and stereometric viewers

5. Data processing methods associated with collection sources used primarily to aid in the collection function

6. Signal recording equipment and techniques forming an integral part of any collection process, and

7. Data intercept techniques or equipment.

Examples of equipment or processes which might be considered to be outside but which were finally considered to be within the scope of intelligence data handling include:

1. Automated map making equipment

2. Pattern recognition techniques and equipment

3. Analog-digital conversion equipment utilized within IDH systems

4. Signal extraction and recovery equipment and techniques

5. Polygraph R&D

6. Error coding and analysis

7. Experimentation and evaluation efforts, and

8. Photo chip handling equipment.

These examples serve to clarify the definition of intelligence data handling adopted by the Task Team and approved by CODIB and which is stated in the Introduction to this report (Section I).

It was apparent, however, that neither the adopted definition of intelligence data handling, the various classification schemes in Appendix 4 nor the exemplary approach above served to identify areas

of intelligence data handling R&D so as to relate them to managerial responsibilities, to applications, to intelligence products or to current funding breakdowns. The Task Team after a great deal of deliberation chose two methods for identifying what it believed to be separable technical entities falling in the domain of intelligence data handling. The first of these methods demanded separation by application[1] and was used for funding breakdowns as well as to identify gaps, deficiencies and needed R&D. Twenty-two such applications were enumerated and are contained in Table III.1 with a very cursory definition. It is interesting to note that the application listing was provided to the Task Team at its initiation and that no changes were made in its make-up during the entire work-period of the Team. The listing was a subset of a listing derived by the Chairman in 1962 to cover Military Applications of EDP- and EDP-Related Research and Development. Its companion piece, also used by the Task Team, was a listing of information by source data types and is contained in Table III.2 for reference purposes. The second method was intended primarily to indicate to management the extent to which intelligence data handling R&D could improve intelligence production and management within the Intelligence Community and should be so presented at this point in the text.

The Task Team believes that intelligence data handling R&D must and should be aimed towards[2]:

1. Experimentation with and evaluation of existing data handling techniques, equipment and systems

2. Development of measures of effectiveness and evaluation criteria for design, evaluation and comparison of data handling organizations, techniques, equipment and systems

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[1] "Application" as used in this context itself contains some ambiguity. It may refer to either a specific intelligence community application (or function) or it may refer to a particular set of scientific and technical techniques or applications. An example of the former use is "calculation of location of fixed objects"; an example of the latter use is "pattern recognition".

[2] In all cases enumerated below IDH-R&D is assumed to involve development of theories, advanced techniques and equipment and their application to the subject area listed. As such, basic research may be required and justified for the Intelligence Community.

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3. Improvement of management procedures for allocation of resources by and within the Intelligence Community

4. Analysis and evaluation of data and data source exploitation practices

5. Development and/or evaluation of information and document control, handling and dissemination techniques, procedures and systems

6. Improvement of organizational structures for performance of Intelligence Community functions

7. Improvement of techniques for deriving finished intelligence and intelligence estimates including evaluative procedures; (e.g., quality control).

8. Development of validity criteria for information including criteria for data purging

9. Development of improved learning and teaching procedures for intelligence personnel (e.g., programmed instruction)

10. Development of reporting mechanisms for R&D project funding and managerial data.

The above listing served to highlight the findings of the Task Team concerning R&D resources within the Intelligence Community. Namely, R&D resources appear to be split into the functional areas of 1) collection (or acquisition), 2) information (or data) handling and 3) specific research studies in support of intelligence production. Examples of the latter include economic research studies, psychological warfare studies, cultural pattern studies and the like. The data-handling functional area possesses the greatest diversity and consequently affects the greatest number of personnel within the USIB Community. There is no question that, as the area exists in reality and as it has been defined by the Task Team, it is too large and diverse to be managed effectively as an entity. There is also no question that, as its many constituent parts become more sharply defined, it will and should itself split so as to be more manageable. The greater danger at the

moment, however, appears to be that a number of essential areas requiring improvement are being neglected because they are not collection oriented, are not research studies and are not thought of as being a part of intelligence data handling because of the parochial and limited view taken by many towards the intelligence data handling R&D area. It was concern over this danger that prompted the above listing.

Another aspect of intelligence data handling R&D which was highlighted by the last listing was the transcendent nature of such R&D. By this is meant the unmistakable realization that IDH-R&D transcends the responsibilities and missions of individual USIB agencies and is indeed of USIB Community concern. Almost without exception the product of a given agency forms merely one part of the desired intelligence product which becomes of necessity a Community estimate or product rather than an agency estimate or product. The implication of this finding is as important as any generated by the Task Team. It underlines the need for R&D projects of a given agency (with a few exceptions) to be based on the recognition of related requirements of other agencies, it emphasizes the necessity for Community priorities to be put on R&D rather than individual agency priorities and it points up the need for a Community mechanism to coordinate and to delegate responsibilities for IDH-R&D among USIB agencies.

B. Discussion of R&D Areas Demanding Increased Emphasis.

The derivation by the Task Team of the two methods selected for defining IDH-R&D necessitated considerable research and uncovered certain R&D areas which seemed to demand increased attention under any criteria established. These are discussed in subsequent paragraphs.

1. Indications and Warnings

Efforts to improve the processing of current intelligence information for purposes of indications and warning have been underway since 1959. Although millions of dollars and hundreds of man years have been expended in applying ADP to this effort, results to date have been disappointing. Because of this, the level of funding in support of R&D efforts in this field is currently low.

In analyzing the reasons for past failures, it should be recognized from the start that the area of

indications and warning is one of the most difficult in the entire field of intelligence processing. It is characterized by the following:

a. Extremely high volumes of data to be processed

b. Wide variety of inputs, processes, and outputs

c. Tendency of inputs to be fragmentary, redundant, and of unknown validity

d. Dependence on all types of collection sources

e. Severe time restrictions on processing

f. Great importance of random and rare events

g. Tendency toward rapid changes in focus of attention

h. Heavy dependence on predictive evaluations.

Added to the inherent complexity of the processing problem has been the inadequancy of the preliminary study which has been undertaken prior to system design. Normally, the intelligence objectives have been stated in such broad terms as to be practically useless to the system designer. The system designer has normally been versed in specific technologies but not in intelligence. The intelligence analysts have known very little about current technology and have been so hard pressed to keep up with current events in their areas of specialty that they have not been able to spare sufficient time to guide the system designers. System designers have concentrated heavily on statistical techniques, particularly with reference to levels of military activity. These techniques are frequently dangerous for such applications because they tend to obscure anomalies rather than to highlight them. The warning problem is more a problem of logical inference than of statistics.

Then, too, evaluations depend principally on the talents of the analyst--his inventiveness and imagination--his ability to sense a pattern quickly--his inductive reasoning--in short, his intelligence. Research and development activity in this field must deal, therefore, with Human Factors studies to a large degree. While Human Factors is an area in which there is much to be accomplished, it has been found to be a most difficult area in which to accomplish much. The human subject is variable and difficult to predict, so that studies have resulted in generalizations rathern than conclusions. It is believed that, for this reason, the spate of Human Factors work in recent years has led to a considerable amount of disillusionment. Several topics can be suggested in this area that do offer promise and should be considered in an R&D approach.

a. Data Presentation. Many automated techniques are now implementable which can ease the burden of the analyst in his rapid handling of large volumes of data. Information can be entered into a data store by prearranged formats so that data on a particular topic is available in cumulative form immediately. Large amounts of information can be observed in simplified structure by automatic arrangement into graphical map and chart form. Direct comparisons among fields of information can be made by combined displays and overlays. Time comparisons in the same field of information are similarly available by use of combined displays.

b. Time Compression. Trends which may be too subtle for the analyst to note with the orderly passage of time may be amplified to a level of recognition by the use of time-compression techniques. Chronologically successive displays can be viewed in a greatly accelerated time frame and this process can be repeated and even reversed at the analyst's desire. These techniques are programmable on a computer whose data stores are properly arranged. In addition to increasing an awareness of past trends,

it might be useful in suggesting future trends, much like the procedure for extrapolating a graph beyond its plotted positions.

c. Query Languages. Not only have computers become more powerful and economically available in recent years, the methods for utilizing them have been greatly simplified. The recent advances in query languages permit direct and immediate inter-communication between operator and computer so that the computer serves as a direct adjunct to, and tool of, the operator. It is now possible, therefore, for an analyst to "game" a complicated problem, in which many variations in probablistic data can be considered in fragmentary data analysis.

d. Communication Fundamentals. The process of communication among people involves far more than the simple transfer of information. To be considered fully successful it must create a chain or network of understanding. They physical sciences have accomplished the task of transferring information. The behavioral sciences have not been as successful in the matter of fostering understanding. This is a critical handicap to the analyst who is seeking to establish meaning from fragmentary information. Very many topics for R&D studies in the behavioral sciences are available. Examples of questions which such studies might answer include 1) Would the establishment of common goals improve the nature and quality of information exchanged among people? 2) Would the opportunity for personal contact improve the overall understanding? and 3) Would group activity among analysts (like "brainstorming") provoke ideas, heighten the imagination, and contribute to solutions? The contribution of the social psychologist in this field may be considerable.

If one were to attempt now to design an ADP system to assist the analyst in the function of warning and indications, the following methodological considerations would have to be taken into account:

a. Document search

b. Interrogation of intelligence analysts

c. Observation of existing manual analytic processes

d. Experience with operational systems

e. Research on types of indicators

f. Analysis of the intelligence "infrastructure" which must support the system

g. Manipulation of the ADP system under laboratory conditions.

To date, system designers have confined their efforts almost exclusively to the first four methods, probably because these are generally straightforward and the least costly. Inadequate effort has been expended on methods e and f, and virtually none on method g. The result has been that the objective of system design has amounted to little more than an attempt to automate some part of what is already being done manually. The value of such an objective is highly questionable, given the inherent superiority of the human mind over machine capability in such areas as judgment, imagination, and inductive reasoning.

With reference to method e above, lengthly lists of indicators have been prepared by various intelligence organizations, including USIB. However, the individual indicators have comprised general statements of ominous events or conditions which it is assumed would occur prior to hostilities. Until recently, very little effort was expended on developing lists of specific phenomena which individual collectors should look for as evidence that these ominous events or conditions are taking place. Thus, what is needed in the indications and warning field is extensive research on "indicators of indicators," the forwarding of individual items on such lists to appropriate collection activities, a reporting system designed to permit rapid communication and processing, and extensive collation of such indicators in the respective indications centers.

In reference to method f, the success or failure of any automated system is heavily dependent on the related intelligence infrastructure--coding systems, field formatting of messages, communications systems (including digital data links), interface between intelligence organizations, etc. Yet, system designers working in the field of current intelligence have traditionally confined their focus of attention to the information within a given intelligence organization and treated that organization as though it were an isolated entity. The result has been that, on the one hand, only a part of the data which could be made available on any given subject ever enters the system; and, on the other hand, the effort required to convert into machineable form the information which is available swamps the personnel assigned to the task. Only by treating a given subject area (e.g., Cuban Ground Forces order of battle) in its totality can an effective ADP system be developed for that subject.

Finally, with reference to method g, all too little effort has been expended in attempting to analyze in depth the present methods of analysis utilized in current intelligence. It is unlikely that this can be done in the operational environment of any given indications center because research and development cannot be permitted to interfere with the on-going, day-to-day work of such centers. What is needed, therefore, is the testing of present techniques of analysis in a separate facility (laboratory) using live information, and the comparison of the results obtained with the day-to-day products of the present indications centers. In this manner, some of the areas which today are considered so difficult but which seem to offer great potential, such as the cross correlation of different subject files (e.g., [redacted] can be tested in depth.

In summary, although the results of past efforts designed to improve processing capabilities for current intelligence information have been disappointing, the task is not impossible and the general lines of approach for improvement can be drawn. It is believed that the present range of manual analysis can be extended significantly by these new approaches.

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3. Experimentation and Evaluation.

Mistakes will be repeated unless they can be identified as such and made known to others who are attempting the same job. Although lip service is paid to this fact, most groups invoke the rule that finding their mistakes is less important than proceeding and that if mistakes are found, any revelation of them would be harmful to the group and should, therefore, not be condoned. As a result, very few intelligence staffs permit realistic evaluations of their practices or products and results of any evaluation are usually tightly held. The IDH-R&D community cannot afford the existence of such agency or group "pride." Experiments and evaluations of existing systems and of systems in design stages must become a matter of policy and system practice. Much R&D must be done on experimentation and evaluation techniques, however, before any policy can become binding. In the 11-14 year history of formalized IDH-R&D, very few such efforts have been spontaneously sponsored, and very few resources have been allocated to R&D on experimentation and evaluation. The Task Team believes that such R&D must be declared mandatory before

it will ever be adequatley supported and so recommends. In particular the Team recommends experimentation with and evaluation of the following type systems or organizations:

a. Document Control and Dissemination System[1]

b. A Warning and Indications Organization[2]

c. A Scientific and Technical Intelligence Production Organization, and

d. A Multiple-User Automated System.

Simultaneously, the Team recommends a concerted R&D effort to improve experimentation techniques and to develop measures of effectiveness and evaluation criteria for information systems in which man plays a role. To the best of the Team's knowledge no such measures or criteria have been accepted as useful, and R&D underway is uncoordinated and of unknown value.

4. Modelling and Simulation.

There are a number of advocates both within and outside the Intelligence Community who espouse modelling and/or simulation as the most effective means of evaluation and experimentation. There are, of course, many types of modelling possible; so that one of the first steps in the use of modelling is to determine the objective desired and the most simple model which will permit the attainment of the objective. This is the step often overlooked by those who advocate modelling and who find themselves trying unsuccessfully to justify the modelling of the entire Intelligence Community as a first step towards some objective whose immediate context is much smaller than the whole of the Intelligence Community. The collection of data and facts about the real-life environment of which the model is intended to be an image is, of course,

[1] Underway now in DoD

[2] Attempted by CIA in 1962 but with no usable results

essential. The rate and amount of collection possible should be recognized as a constraint upon the model prior to its initiation. Otherwise one who collects such data may find that he is in the predicament of the Alice in Wonderland characters who had to run as fast as they could to stay in place and who would have to run twice as fast to get anywhere. This simply implies the impossibility of freezing a changing environment over too long a data-collection period. Finally, since modelling is an experimental technique, there must be an hypothesis advanced against which the model is to be tested. If this is not recognized, the model will generally be merely a mechanism for data collection and for the generation of conclusions in an upredictable framework. With these admonitions in mind the Task Team believes that limited modelling against formulated hypotheses would be a useful technique for determining bottlenecks, gaps or deficiencies in the intelligence process. R&D could then be initiated against known requirements which were experimentally derived rather than subjectively generated. Figure III.1 contains an illustrative model of the intelligence process developed for the Task Team. Any node of the model may be selected, its immediate constituent environment determined, an hypothesis generated and data collected with results which the Task Team believes could lead to valid requirements for IDH-R&D. Accordingly, it is suggested that several limited models against formulated hypotheses be attempted by IDH-R&D groups within the Intelligence Community under the aegis of the recommended USIB Community policy mechanism and that this be done during the next two years to preclude further unwarranted large-scale system or equipment design projects.

The four areas isolated above as demanding increased emphasis by the IDH-R&D Community could surely be augmented by any group having a longer life and more available resources than did Task Team VI. The Task Team itself identified many more areas in need of R&D but whose justification varied widely depending upon the criteria used for evaluating their urgency. These requirements are not included in the report and must await the convening of a more enduring group--namely, the recommended IDH-R&D policy mechanism (Section II).

Before concluding the discussion of technical considerations of intelligence data handling research and development, some comments on the SCIPS effort appear required. First of all, the Task Team found the conclusions and summary presentations extremely useful. The raw data collected by SCIPS, on the other hand, was not usable to test any hypothesis advanced by the Task Team. What is perhaps more enlightening is that the conclusions of the SCIPS effort within the province of the Task Team were generated by Task Team members without the need for or use of the data-collection effort of SCIPS. Concomitantly, the Team's ability to validate its findings in its area of interest is no better or no worse than that of the SCIPS group in its particular area of interest. Serious reflection on these above points leads one to the observation that the many criticisms levied on the Intelligence Community for not making more use of or not immediately complying with the SCIPS findings are unjustified. Neither the Intelligence Community nor any other similar group has the technical or managerial competence to translate from such a mass of accumulated data to a set of resultant community actions which are aimed at general community improvement. Criticism should instead be aimed at 1) the dearth of R&D support for efforts aimed at the synthesis of raw data into informational units permitting the transfer of information into courses of action, 2) the lack of education and training provided to R&D management in techniques of information synthesis and information transfer and 3) the permissiveness of IDH-R&D management which allowed the initiation of the SCIPS effort when application of experimental design principles would have shown that the effort was not properly structured to yield results that the community was capable of exploiting.

For a summary review of Intelligence Data Research and Development Potential the reader is referred to Appendix 2.

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IV. Allocation and Resources

A. Funding.

1. Techniques Used in Collecting Funding Data.

a. Funding data was collected by agency and application area for the various intelligence data handling research and development (IDHR&D) efforts, identified as falling within the purview of this task team. Table IV.1 reflects the totals by application areas.

b. Wherever possible, currently available funding figures were collected and used in accumulating the total IDHR&D expenditures. In certain instances, funding data were not available or were only partially usable. This occurred when addressing newly established projects, which had not been completely defined and when addressing individual tasks within a given project. In such cases, except for NSA and CIA, the funding data were obtained from the task/project officer of the sponsoring service/agency concerned. When this recourse failed, it was necessary to extrapolate the funding data from currently available technical development plans and RDT&D project reports (DD613's and/or DD1498's in the case of DoD). Available DoD figures were used for appropriate NSA tasks and projects.

c. Selected tasks/projects were evaluated, to the extent that they supported each of the application areas. It should be noted that this division and allocation of individual task/project efforts into the various application areas involves a measure of human judgment which must be taken into consideration. The associated task/project funding was divided also on a somewhat qualitative basis and was placed into the appropriate application areas.

2. Analysis and Conclusions.

Primarily, the largest IDH-R&D expenditures are in those R&D areas where the Team recommended that the Intelligence

Community should be essentially self-sufficient. The one exception is the area of warning and indications (See Section V).

It should be noted that within the Systems Management area, no funds are allocated to Library Management, suggesting that the processes and techniques required in this area are either being satisfactorily developed outside R&D mechanisms or need further identification for R&D funding.

Other conclusions concerning relative funding for different application areas, are easily derived from direct observation utilizing the second and third columns of Table IV.1 which list absolute funding and rank order of the application areas respectively.

The Team believes the funding figures to be accurate within 50-100% of actual costs. Accordingly, conclusions should be drawn cautiously from Table IV.1. The funding errors are probably evenly distributed so that the rank ordering of application areas can be used for comparative purposes.

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V. The Self-Sufficiency of the USIB Community in Intelligence Data Handling Research and Development

In Section II it was stated that the greater part of the technical competence in general information handling (or information sciences technology) lies outside the intelligence community. In both Section II and Section III it was emphasized that many aspects of intelligence data handling are identical to those of general information handling, and the research and development objectives of one are directly applicable to the other. For example, developments in multi-font and all-font optical print readers are needed to improve general information handling. They are needed for intelligence data handling also. New storage mediums, large random access memories, language translation and man-machine communications are further examples of areas where improvements will benefit the entire information handling community. However, there are areas in data handling where the intelligence community should or must be self-sufficient in research and development. Identification of these areas will allow management to concentrate limited intelligence community resources in areas where the investment return will be of maximum benefit to USIB Community intelligence objectives.

Determining research and development areas where the intelligence community should be self-sufficient requires weighing the particular area against the following criteria:

1. Are the requirements, techniques and/or processes essentially unique to the intelligence community?

2. Are the classification safeguards such as to preclude participation by groups outside the intelligence community?

On the basis of these criteria, the Task Team believes, as a
25X1 result of its investigations, that the intelligence community should be essentially self-sufficient in the following IDH-R&D areas:

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It should be noted that throughout the preceding discussion the notion of "essential" self-sufficiency was implicit and was used intentionally as distinct from "complete" self-sufficiency. This is due to the well-accepted tenet that all the uses of a particular area of research can never be predicted. As a result, improvements or even breakthroughs in any of the above areas could result from research done in completely distinct areas not within the purview of the IDH R&D community. Recognition of this situation serves to point out why only seven areas were singled out by the Task Team as requiring essential self-sufficiency on the part of the Intelligence Community and leads naturally to a discussion of the overlapping interests of the Intelligence IDH R&D Community and the remainder of the Scientific and Technical R&D Community.

The Task Team found it difficult to provide a measure or an indication of the overlap of interest between IDH R&D and other R&D Communities. To get a first handle on this overlap it was decided to utilize the National Science Foundation publication Current Research and Development in Scientific Documentation, No. 13, November, 1964, as the most comprehensive and accurate listing of ongoing R&D in its area of coverage. The R&D areas covered in this publication are:

Information Needs and Uses
Information Storage and Retrieval
Mechanical Translation
Equipment
Character and Pattern Recognition
Speech Analysis and Synthesis
Linguistic and Lexicographic Research
Artificial Intelligence, and
Psychological Studies

Some 495 projects were covered in the publication and each one was reviewed individually with regard to its relevance to IDH R&D. Of the 495 projects, 462 were judged relevant (i.e., of use to) IDH R&D interests. This implies that 93 per cent of the known ongoing R&D

in information sciences is of potential use or interest to IDH-R&D. Furthermore, a large percentage of this R&D (more than 75 per cent[1]) was sponsored by R&D organizations outside the IDH-R&D Community. Approximately 30 per cent of the projects involved research and development in information storage and retrieval. The areas of information needs and uses, mechanical translation, character and pattern recognition, linguistic and lexiocographic research, and artificial intelligence each contributed approximately 10 per cent of the number of projects examined. The judgment of relevance invoked in the analysis is, of course, subjective, but the Task Team has its findings tabulated and can, therefore, provide a listing of relevant projects and can state that the analysis is a reproducible one.

The findings of this Section; namely, the isolation of seven IDH-R&D areas in which the USIB Community should be self-sufficient, along with a measure of the large degree of overlap between IDH-R&D and information sciences R&D lead to two recommendations.

1. The larger portion of IDH-R&D resources should be allocated to the seven areas requiring self-sufficiency, and

2. The recommendation in Section II asking for the production and dissemination of a report listing available information services and usage procedures should be expedited with maximum haste.

With regard to the first recommendation, the findings of Section IV on current funding allocation indicate that R&D resources appear to be properly assigned. However, more analysis is necessary to demonstrate the existence of useful products and to ensure continued maintenance of this allocation balance.

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[1] Based on a random sampling of the 462 projects.

VI. Intelligence Data Handling Processes

Those types of data which contribute most to intelligence production have been determined to be natural language text, imagery, digital and analog signals, and derived prescribed reporting (e.g., IR's). There appear to be a denumerable set of operations to which these data types are subjected from the time they enter the intelligence production cycle upon receipt from collection until they are presented in final form to their ultimate users. These procedures may be classified in many ways. One way which has proven quite valuable in highlighting the type of research and development needed is a classification based on the degree of intellectual activity required in the performance of the procedure. Three levels of intellectual activity have been successfully used to separate into groups the more important procedures identified in the overall intelligence data handling process. These levels, simply labelled first, second and third levels, can be qualitatively distinguished as follows:

First level of intellectual acitivity - not describable either as an algorithmic or a heuristic process. It appears to require human intelligent behavior to a great extent.

Second level of intellectual activity - Allows algorithmic or heuristic solution but only under control of human intelligent behavior or through human intervention during the process. It requires an effective man-machine dialogue when "machines" are utilized.

Third level of intellectual activity - frequently is of a repetitive, clerical or mechanical nature. It is completely algorithmic in nature and any human intelligent behavior required can be adequately simulated by "machine."

Table VI.1 presents some fifty-five different procedures categorized in these three modes. It should be evident that (1) the procedures occasionally repeat in more than one of the categories, indicating a wide variation in their scope; that (2) a number of the procedures must be defined differently depending on the type data to which they are applied; and that (3) the listing is not all-inclusive. For these reasons, no unique definition of each term is attempted in this report. It is obvious that current practice permits multiple definition of many of these

terms so that repetition of procedural titles is found between levels whereas precise definitions of these procedures would indicate their variance as they are applied using the different levels of intellectual acitivity.

The Task Team recommends that a project be sponsored to define and perhaps re-label the intelligence data handling processes identified, to determine those processes critical to different intelligence applications and which are in need of improvement, to categorize on-going IDH-R&D efforts so as to identify which processes will be improved by the accomplishment of the efforts, and to recommend R&D efforts to improve those processes which are not being improved by the on-going R&D.

The adoption of the recommendation will result in a clarification of the entire intelligence cycle in terms of information processes involved and will eliminate much of the current confusion and lack of preciseness inherent in most descriptions of intelligence applications.

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VII. Recommended Actions For Immediate Initiation

Previous sections in the report have contained a number of conclusions and recommendations with no rating pertaining to priority or time-phasing. The Task Team has selected from these, five recommendations which it considers essential for immediate initiation. These are identified in the following paragraphs along with a cursory discussion in order that this section may be somewhat self-contained. The five selected recommendations are not internally ranked in this Section with respect to importance or urgency since the Task Team believes they should all be adopted. However, there is no restricted interdependence; i.e., any combination of them may be independently adopted. Detailed discussion and back-up data are contained in other sections of the report and should be referred to.

1. Establishment of a R&D Policy Mechanism to Advise Chairman, USIB.

The establishment of a policy mechanism for formulating IDH-R&D objectives and policies assumes high priority. Without such a body there is nothing to which the accomplishment of IDH-R&D projects can be related or addressed. Detailed discussions of this mechanism and the need for it are contained in previous sections of the report (See Section II for details). USIB Community resources required are a full-time executive secretary, membership from each USIB agency with periodic meetings and funding to support needed consultant services.

2. Warning and Indications (Predictive Calculations).

More allocation of resources--both funding and Intelligence Community personnel--should be directed into improving our warning and indications capabilities as this is one of the foremost functions of intelligence. (See Section III. B. 1.). Early expensive failures in this field of IDH-R&D no doubt have resulted in "burnt fingers;" but both techniques and equipment have since improved, and new efforts should be undertaken. Past failures must provide an educational background in avoiding the repetition of previous pitfalls. Efforts undertaken must be coordinated on a Community basis and not be isolated undertakings of a single agency. The input data for warning and indications is recognized as the responsibility of several USIB component agencies. Additional funding required for contractual assistance would be nominal for the first

two or three years--probably approximately [redacted] each for NSA, CIA and DoD. Each of these agencies should assign at least two people to assist in this type project on a part-time basis for a period of approximately one year. This effort should be one of the first to be sponsored by the recommended IDH-R&D policy mechanism. 25X1A

3. Funding of a Report Listing Information Services of Use to the USIB IDH-R&D Community.

A comprehensive report is needed which would list those information services, either sponsored by the Government or which are available by other means to members of the Intelligence Community and which contain information of use to the USIB IDH-R&D Community. The report should include details concerning usage of listed information services. The production of the report should be followed by an R&D effort aimed at determining improvement or changes in the information usage patterns of members of the USIB R&D Community as a result of the "forced-feeding" of knowledge concerning available information services via dissemination of the subject report. The Task Team considers it unnecessary to conduct a survey of information usage patterns within the USIB R&D Community prior to distribution of the report but very worthwhile subsequent to distribution (See Section II). The report would have to be contracted out to an outside group and would require in addition the active involvement of selected members from the USIB Community. The report and subsequent survey should not cost over
25X1A [redacted] for a nine months effort and should be mutually funded by the members of the USIB Community (See Section II).

4. Evaluation of Two Different Types of IDH Systems to Determine and Establish Methodology Criteria.

It is proposed that two different types of IDH systems now in existence be singled out and selected for formalized experimentation and/or evaluation. Inasmuch as this has never been done before there is presently no authoritative criteria for determining what constitutes a reasonable IDH system. In the past, IDH systems have been developed to meet recognized requirements, but without the benefit of established guidelines to insure that the requirement was fulfilled. Consequently there is an urgent need for the USIB Community to recognize the need for, to sponsor and to conduct experimental evaluation of at least two different types of existing systems. Such systems might include a document handling system, a real time warning and indications organization or a biographic retrieval system.

It is anticipated that these evaluations will be costly both in people and resources, since it will be a first-of-a-kind experience and will demand more diversity of competence of both USIB Community participants and contractual personnel than most R&D efforts. It is estimated that the first attempt should require about two years per
25X1A system costing about [redacted] for each system. This is in addition to the costs covering USIB Community participants who will have to be assigned to the tasks. Considering the extremely large amounts spent in the past on unsuccessful IDH systems developments, the cost is not considered excessive. Rather, the cost is justified simply as a protective mechanism against further proposed system design and development efforts known intuitively to be useless before initiation but for which there is no technical foundation upon which to judge their inappropriateness (See Section III).

5. <u>Establishment of a Feed-Back Mechanism Between Finished-Intelligence Users and Producers and the IDH-R&D Establishment</u>

There is presently no established procedure whereby producers of finished intelligence can have their knowledge of general shortcomings in existing operational procedures, practices and techniques translated so as to determine the most rewarding areas of exploitation in IDH-R&D. Such a translation requires inter-personal communication between users and producers of intelligence and IDH-R&D personnel. No mechanism exists to measure and make known the results of good or bad usage procedures of existing IDH capabilities in the production of finished intelligence or intelligence estimates. In the production of finished intelligence, the results are written up, utilized by USIB and its member agencies with very little if any subsequent follow-up attempt to assess why the estimate proved to be incomplete or in error. A mechanism is needed (an informal review group is recommended), which would determine whether or not the IDH capabilities were adequately exploited and good usage made of all the available data.

The existence of the review group would ensure feed-back analyses from the producers of finished intelligence to the IDH-R&D policy mechanism for further study to uncover faults and improve IDH capabilities. This would have many beneficial results to the intelligence community as a whole, resulting in improved IDH capabilities including equipment, techniques and personnel. It is recommended, therefore, that means be provided for finished intelligence producers to work more closely with IDH-R&D groups in order to improve IDH systems. It is believed that the best possible improvement would result from the closer working relationship between finished intelligence producers and IDH-R&D personnel.

afforded by the existence of an informal review group. The review group itself could be formed within the recommended policy mechanism. However, there is need for an initial analysis to determine feasible feed-back techniques. This will require the part-time services of three-to-five experts from the USIB IDH Community for about one year as well as the full-time assistance of two outside experts at a cost of approximately [redacted] (See Section II).

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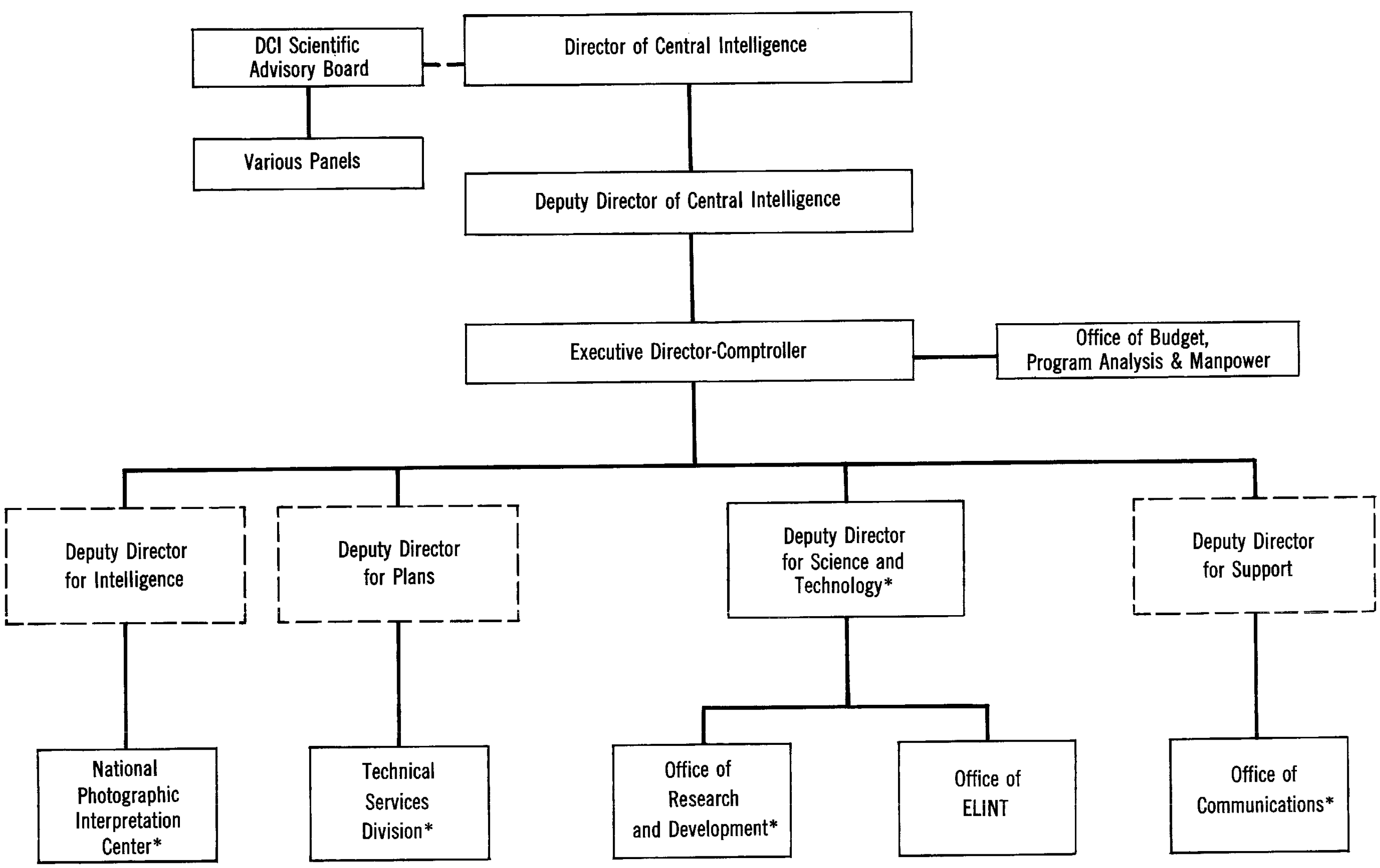
Chart 7



*Members of R&D Review Board, Chaired by DD/S&T.

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Appendix 2

INTELLIGENCE DATA HANDLING RESEARCH AND DEVELOPMENT POTENTIAL

1. An Overview

The improvements and advantages potentially available to information handling activity through developments in the information sciences are most often described by a particular device or technique, affecting one part of the process. It is suggested that, before this is done, a more general view be taken of how the overall process is affected.

a. System Analysis. If advancements in information handling and automatic data processing techniques are to be applied successfully to a process, we must begin with a system analysis. This will place each element of the system in proper perspective, and then group the elements in a manner that will permit the system to accomplish its mission in an effective manner and with a minimum expenditure of resources. The analysis may start with a review of functions to be performed (definition, delineation, requirement); proceed through a definition, quantification and evaluation of the parameters inherent in the geography and timing of the system elements (data base, data routes, traffic rates and patterns, space and time relationships, etc.); and finally, study the methods of implementation for optimum performance of the entire system. Quite often, so much is learned about system improvements from these first two steps (analysis of functional and space-time parameters) that the implementation analysis seems anticlimactic. A rigorous system analysis applied to Intelligence Data Handling may be similarly salubrious.

b. Simulation. System simulation is a powerful technique now available for gaming and evaluating the operation of a projected system, taking into consideration the specific hardware implementation, communications netting and contemplated space-time relationships. The availability of sophisticated compilers, simulation program routines and powerful general purpose processors makes possible the simulation of even complex system operations. Reasonable preparation

time (weeks) and reasonable running time (hours) are usual. System parameters and configurations which are difficult to define can be varied in the simulation run for optimization analysis. The advantages of this system simulation technique increase directly with system complexities and uncertainties.

c. Data Reduction. When applied properly to massive information networks, new information handling techniques may accomplish as much good in data reduction as in data storage and retrieval. Data reduction can be far more than just convenient compilation and summarization. It can include pattern recognition. It can also include conversion of bulk data to more understandable graphics, such as maps. If the system designer remains everconscious of the dangers of eliminating important data in the act of reducing data to more convenient, storable, and recognizable forms, the process of data reduction may be applied to great advantage.

d. Massive Network Practicality. For an information handling system which is large in size, and complex in its network of social interconnections, an irreducible minimum is encountered in the time it takes for an action to be processed through it, depending on the number of manual (human) transfer and terminal points that are encountered. This minimum time seems impervious to urgency, pressure or directive; and many of the evils of bureaucracy accrue from this feature of large systems. If large information systems tend to remain complex and cumbersome despite all efforts at system improvement, they can be made more practical and acceptable in operation by wise application of automatic data processing devices. Increased speeds and capabilities of information storage and retrieval, standardized approaches to information classification and formatting, and machine-aided manual activities are some of the approaches now available for accomplishing this objective. Greater speed of response, improved accuracy and reliability, capability for redundancy in data base and operations, even economy, can be obtained if the system is designed wisely. (And very little good, at great expense will result if done carelessly.) While the above are methods applicable to all information handling systems, research and development approaches more specifically tailored to the special needs of Intelligence Data Handling can be made.

e. System Experimentation. While system analysis and system simulation provide valuable insights, there are certain "realities" which can be introduced and evaluated only through some level of experimentation. These are, to a major degree, the effects of human factors, and, to a lesser degree, the limitations of practical communications. (It could be for these very reasons that the Prussian General Staff adopted their cynical observations that "No plan survives contact with the battle.")

The role of the human operator in a system remains sufficiently variable and unpredictable so as to defy simulation. It could only be gamed by using people. The effect of communications is a more subtle factor, and its value in system experimentation depends completely on how realistically it is introduced, i.e., -- availability of channels, realiability,, error control, typical quality, capability for verification and authentication, vulnerability to accidental or deliberate interference, etc. So many systems as designed turn out in practice to be communications limited, that special pains to introduce practical features of communications in experimentation are warranted.

In experimentation it is not desirable or necessary to duplicate the entire system. A "single-thread" model is sufficient in which at least one of every type of sybsystem element is contained. As indicated above, typical staffing and interconnections should be employed as far as possible.

f. System Evaluation. System evaluation can and should go well beyond investigation of system action under normal circumstances, it should help prepare for and accommodate the typical. If system experimentation is properly designed and executed, the evaluation can include such valuable insights as performance under adverse environment; the individual and cumulative effects of subsystem outages; the need for back-up procedures, manual or automatic, at particular system locations; the value of redundancy in data base and control; and the need for acknowledgement of critical transmissions. Designing for system survivability under adverse circumstances is admittedly an expensive feature, most often omitted from commerical systems. It seems warranted for Information Data Handling.

Among the many factors of human conduct to be evaluated in system experimentation, one of particular interest is the Error Generator within the system. Too often an ambiguous situation is

resolved prematurely at a low echelon of information entry by a human operator who feels obligated by standard operating procedure, or forced by assigned information format, to make a clear choice. In an automated system this unwarranted "decision" is transmitted rapidly and widely through the system with little opportunity for review, serving to misinform and influence other decision. System evaluation should be particularly sensitive to opportunities for the introduction of errors, such as this, in the system design.

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Because methods have increased and improved, a very significant system impediment may arise, that of over-display. Surplus information, not bearing on the situation, or excess information, serving to repeat what is already present, might be presented. Surplus and excess information could definitely be deleterious to the decision maker, serving to slow him down and confuse him to an extent depending on the complexity of the problem faced and his own capabilities. This aspect of over-display warrants investigation in system experimentation.

Another potential limitation in information display could be a too-rigid assignment of standard formats. The same process that would permit the human operator to resolve an ambiguity without rational basis because he thinks such a resolution is expected of him by nature of the format, would prompt him to omit the entry of vital information because the format doesn't encourage it. Some compromise between format and permissivity must be evaluated in system design of information entry and display.

2. Developments in Techniques

Any attempt to describe pertinent developments in devices would

be obsoleted by tomorrow's newspapers; moreover, device development is an industrial juggernaut moving fast enough without any further impetus. However, many general Information System techniques now in research and development are of considerable potential for improving Intelligence Data Handling and should be considered, particularly if specialized continuation is considered necessary. It may be observed that the techniques described below are independently interesting, but are closely interdependent for maximum exploitation.

a. Mechanized Language Translation. Work on MLT is widespread. It does not yet offer a substitute for the human translator, but does produce a translation which identifies subject matter, treatment of subject and descriptors which may permit classifying or cataloguing the document. It is believed that present MLT techniques could permit the "machine" to aid the human translator materially.

b. Character Recognition and Page Readers. Many successful, versatile and reliable character recognition devices have been designed. They have not yet resulted in similarly successful page readers because the "page" and the "page" format have not been standardized, and therefore the "page" handler cannot be designed economically. If a physical "page" arrangement were defined for Intelligence Data Handling, then a page reader could be readily developed for use in document translation abstraction, extraction, indexing and other forms of analysis.

c. Automatic Abstraction, Extraction and Indexing. Developments in large memory structures, content-addressable memories, list processors, and indexing techniques make automatic abstraction and extraction a realizable goal.

At the present state of research, abstracting is essentially an activity of extracting.

In automatic abstracting, an evaluation is performed on various portions of a document, in order to ascertain what portions are significant enough to be retained and what portions should be omitted.

Automatic abstracting uses documents in natural language at the input, and the system has to be capable of recognizing content indices

in natural language text in order to yield at the output the required condensed representation.

The ordering system used for the storage of information is called a system of indexing, since it is comparable in its purpose, though not necessarily in its structure or efficiency, to the index of a file or library.

It is possible in the future that an automatic abstracting system may be capable of rewording the sentences extracted for retention in the abstract by generating natural text of its own.

Development of techniques and algorithms, utilizing advanced memory structures, coupled with efficiently organized file arrangements, indicate considerable promise in alleviating the current problems in the area of abstracting, extracting, and indexing. The specialized needs of intelligence data handling would be considerably improved by the development of these techniques.

d. Memory Structure. The field of large memory structures seems to be on the verge of revolution. The progress being made on very large, statis (all-electronic) memories is so rapid that a conversion from the present, bulky, unreliable, electro-mechanical memories to low-cost, small size, all-electronic forms is predicted within the next five years. The potential of detection and correlation techniques, mechanized language translation, and overall system reliability, to name a few areas, is great.

e. Speech Recognition by Machine. The recognition of speech by machine, in an unrestricted vocabulary from any speaker is a desirable, but, as yet, very distant goal. If however, the vocabulary were restricted to a limited set common to a particular function, and if a short period of adaptation or "training" on the speaker's voice characteristics were permitted, the goal of automatic recognition might be realizable. Further progress in this field awaits a better definition or requirements.

f. Compiler, Query Language and Natural Language Developments. The transitions from machine languages to assembly languages to compiler languages in recent years have made the preparation of machine programs successively simpler (and the design of machine languages much more difficult). The recent introduction of query languages permits direct access to a processor for immediate man-machine intercommunication without the prior preparation and debugging of a program. It is expected that work on languages will aim at a

"natural" query language similar to ordinary conversational languages. While a "natural" query language still seems a distant goal, the achievement of less "unnatural" query languages is assured. This would permit greater freedom of action in man-machine interplay and could make a significant contribution to Intelligence Data Handling in machine-aided file searching, machine-aided analysis, and other areas. Development continues in the area of special purpose programming systems. Problem oriented languages solve specific problems, have increased flexibility and ease of use precisely because the problem areas addressed are extremely narrow and specific.

g. <u>Time Sharing.</u> Significant accomplishments have been achieved in the area of computer time-sharing. Utilizing software techniques, the computing system has the ability to be accessed simultaneously by a large number of separate users. A time-sharing computer can be viewed as a kind of public utility from which any user can draw whatever computational power he might need at any time without delay or difficulty.

A prime requirement for time-sharing is fool-proof memory protection whether it be done in software or hardware. Notable accomplishments in time-sharing have been the development of proper algorithms for scheduling, development of routines capable of restoring programs interrupted for continuation processing, and the development of sufficiently sophisticated executive routines to minimize delay time experienced by the user between his input and the system's response. 25X1B

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Long distance access into a time-sharing computer system can be considered to be an important information data handling potential for the Intelligence Data Handling.

h. <u>File Structure Organization.</u> Limited advances have been made in the area of file structure organizations for large dynamic information retrieval systems. In the past this area has received limited attention, but as data processing equipments become more sophisticated and requirements for specialized information become more complex, techniques for improved retrieval through advanced file structures and data arrangements will be required.

Systems exist which utilize list processing techniques wherein addressing indexes in the form of trees provide access to the main file, which in turn can be accessed by different types of descriptors.

Responses to information retrieval requests can be improved by developing fast algorithms to take advantage of advanced file organizations. Initial results on associative processing techniques utilizing associative file arrangements show substantial promise for improving user response times.

Optimal file structures for information classification and formatting of typical application areas can improve the presently limited capability and usage of query type languages. Considerable investigation is required to achieve results that could be useful for enhancing this segment of intelligence data handling.

i. <u>Generalized Data Management Systems.</u> Recent developments in the area of generalized data management systems have emphasized the inclusion of general purpose programming as well as job specific programming, user-on-line techniques as well as special purpose languages, and, if possible, making the resultant design time-sharing and into a single operating system.

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Two such systems, [redacted] have attempted to construct, within the confines of one computer system environment, programs which incorporate and sophistication and power of generalized executive routines, the job specific concentration exhibited by the functional sytems, the flexibility and power of user-on-line systems, the narrow band specificity of problem oriented languages and, to a lesser extent, the special sense of generality implied by time-sharing.

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k. <u>Document Handling, Control, and Dissemination.</u> Progress in the area of document storage and retrieval is continuing at a slow pace, but is beginning to show signs of acceleration as researchers develop operational techniques and comprehend the complexity of field.

Research is underway on the application of machine methods of storage and retrieval to the literature of a number of specific application areas. The three major areas in which the human being plays a singular or supporting role which must be considered in the man-machine interface are: the selection, processing, and searching or recorded documents.

In the selection area one must make value judgments that the material chosen will be of continuing interest and that the proper setting of limits of relevance will assure that only pertinent documents are selected.

Processing can be divided into three decision elements: selection of abstracting method, depth of document analysis, and control of terminology. Compromises are required in each of these element areas as well as in the overall areas in order to operate an efficient, meaningful system.

The area of searching also requires a considerable amount of preliminary human endeavor. Questions are usually structured logically, using various Boolean functions.

The timely and accurate dissemination of documents, abstracts, extracts, etc. to the requestor is another problem area not efficiently automated.

Researchers have begun the study of the development of fundamental theory of documentation. Work is still required that will lead directly to improvement in methods of searching, document analysis, and to an increase in the general efficiency in the system. Continued basic research in the development of information retrieval theory is a requirement not only to satisfy the needs of business, scientific research, library service, but also mostly importantly, to improve the voluminous, myriad applications of Intelligence Data Handling.

25X1B 1. <u>Fragmentary Data Analysis.</u> Achievements in the area of predictive calculations have been increasing at a moderate rate.

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Estimates, indicators, and warnings based on fragmentary data analysis, might provide Intelligence Data Handling with timely speculative information required for decision making.

A significant program to analyze and define the needs and application areas for intelligence data handling requiring predictive calculation methods is necessary in order to take advantage of these mathematical techniques.

Appendix 3

This Appendix contains a copy of the Terms of Reference and a list of the Task Team VI Members.

CODIB-D-111/1.6/3
31 March 1965

UNITED STATES INTELLIGENCE BOARD

COMMITTEE ON DOCUMENTATION

TASK TEAM VI - RESEARCH AND DEVELOPMENT

Terms of Reference

I. Scope and Objective

A. "It is the mission of CODIB to promote means by which the Intelligence Community can make optimal use of information of intelligence value, however recorded." (DCID 1/4, June, 1959) Within the scope of the CODIB mission this Task Team will concern itself with research and development associated with improvement of techniques for handling intelligence data.

B. In this regard the Objectives of the Task Team will be:

To define and describe goals for research and development to meet information processing needs within the Intelligence Community.

C. The Task Team will restrict its scope by only considering goals which are common to more than one member agency organization. Further, it will not concern itself with collection processes through which intelligence data is obtained; similarly, it will emphasize goals concerned with that type data or information which CODIB members believe to be of primary interest within the CODIB mission. Finally, the Team will be receptive to problem areas requiring research and development which are transmitted to it by other Task Teams.

II. Definitions and Approach

A. The phrase "intelligence data handling" is interpreted to include the processing of intelligence data among and between humans and machines. It includes the functions of receipt from collection

sources, transformation, coding, storage, search, retrieval, manipulation, presentation and delivery and it involves usage procedures. It is concerned with existing and potential techniques, both manual and automated which offer promise of improving intelligence data handling techniques. Intelligence data itself includes messages, reports, recorded signals, photographs and charts. Intelligence data handling R&D will, of necessity, involve media containing the data; e.g., documents, tapes, magnetic storage, film reels and the like. The Task Team will only concern itself with those aspects of intelligence data handling allowed under its scope as defined in Section I.

B. Group tasks aimed at attaining the Task Team Objective will include:

1. Identification and understanding of selected aspects of intelligence data handling.

2. Identification of research and development needed to meet stated goals defined and described by the Task Team.

C. In accomplishing these tasks the team will:

1. Review the data and results of study and experience which are available to Team members and generate useful conclusions.

2. Arrange for consultation with individuals who have a leading role in the research and development progress made in the scientific disciplines and the technology which have a bearing on the Task Team objectives.

D. The Task Team report will attempt to provide information in accordance with the Team objective which CODIB and the several USIB agencies may use as desired in carrying out assigned responsibilities and missions.

III. Membership

A. Membership is open to all USIB agencies. In addition, consultants from the National Science Foundation and the National Bureau of Standards will be required. Individual members must have Top Secret clearances and special clearances as required.

B. The CODIB Support Staff will provide a Team member who will act as Team Secretary and provide support as required.

IV. Guidance

The group will be under the guidance of CODIB.

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MEMBERS OF TASK TEAM VI

RESEARCH AND DEVELOPMENT

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